

Two compartment phantom for modeling hepatic tumors

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Liver Cancer Statistics

5th Highest Incidence

3rd Highest Mortality

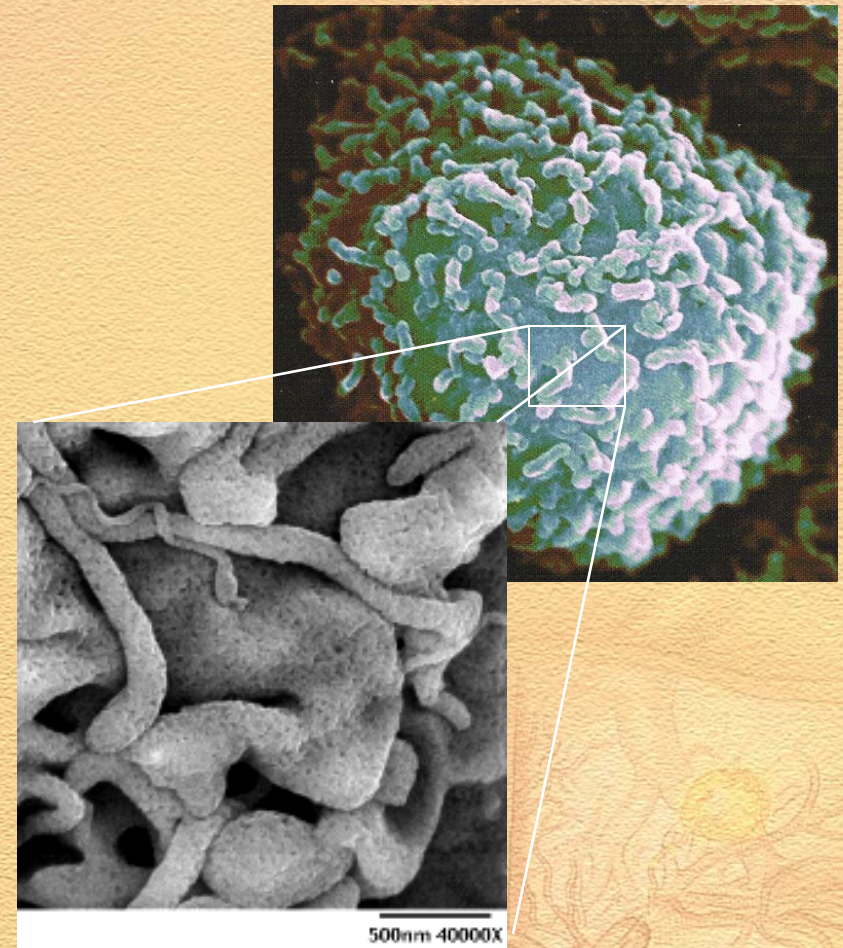
Incidence: (new cases)

Hepatocellular Carcinoma

World: 600,000/year

US: 22,000/year

5-year survival: 7%



*Cover, Oncology Times Special Supplement on
Colorectal Cancer, May 2005*

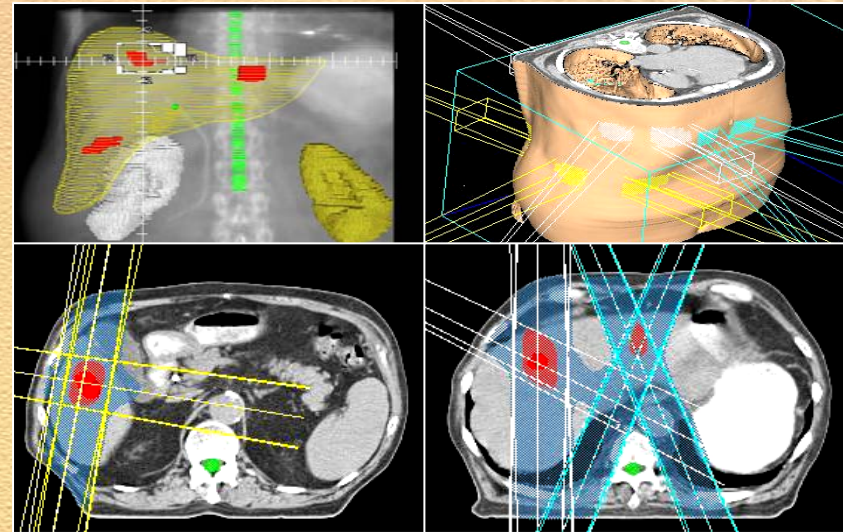
Treatments-old favorites

- Chemotherapy
 - Liver cancer tends to be resistant
 - Limited use
- Resection
 - High survival, if all removed
 - Invasive, complications



Treatments-future

- Radiation
 - Effective
 - Harmful to regional organs
- Radiofrequency Ablation
 - High recurrence rate
 - Few complications



How to study treatments?

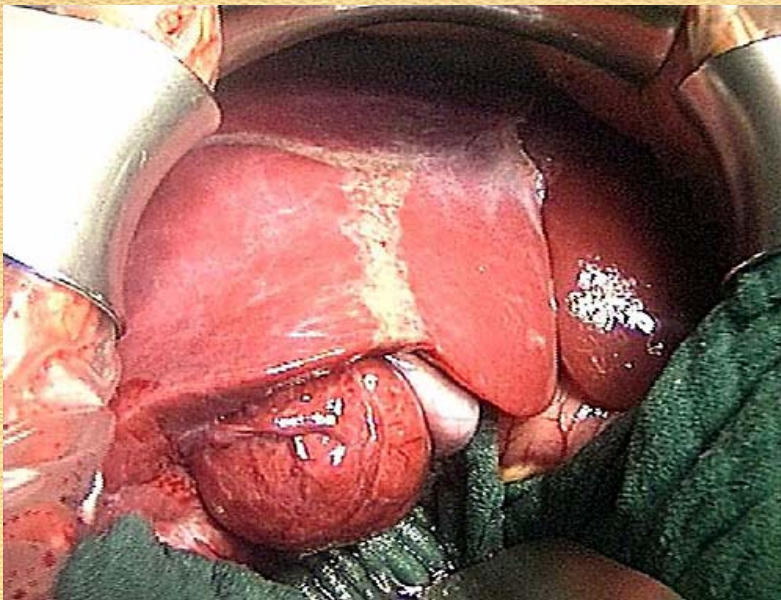


- Computer Simulations- not clinically relevant, based on ideal models
- Animals- OK models, difficult to correlate, expensive, time consuming
- People- IRB nightmare, illegal



Phantom

- **phan tom** (fan tom) *noun*
 - a **model** of the body or one of its parts

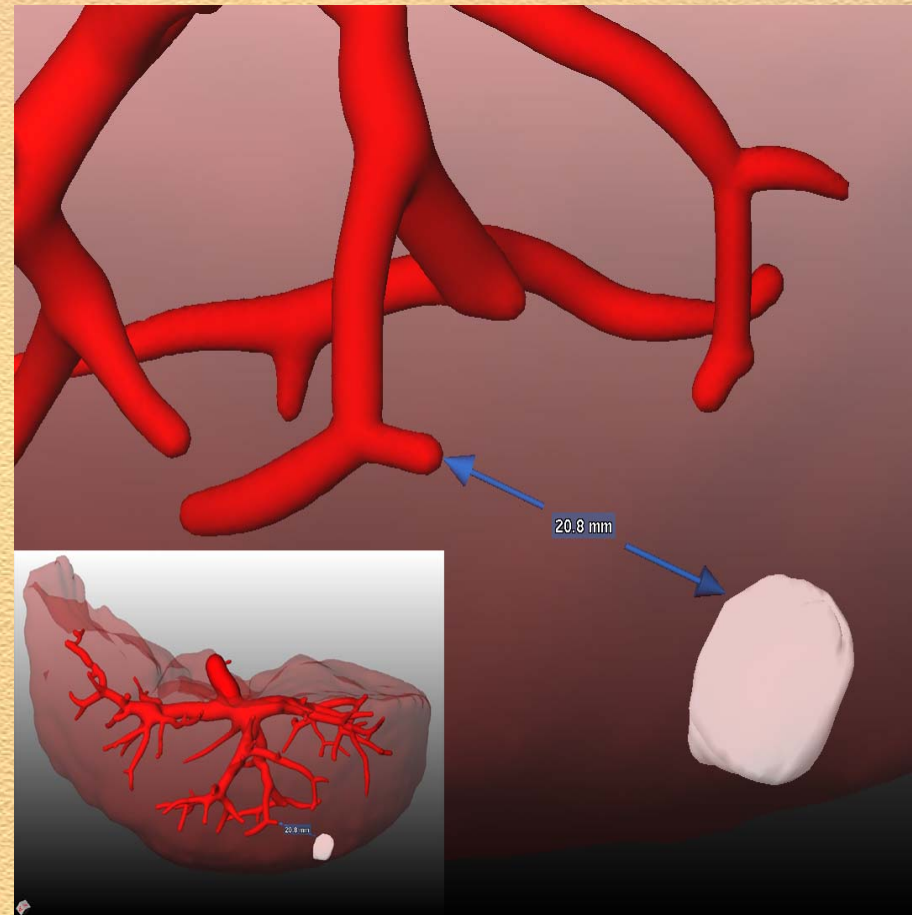


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Properties

- Imaging:
 - MRI
 - CT
 - Ultrasound
- Radiofrequency Ablation
- Radiation Therapy
- Resection



Hypoxia – Tumor Size

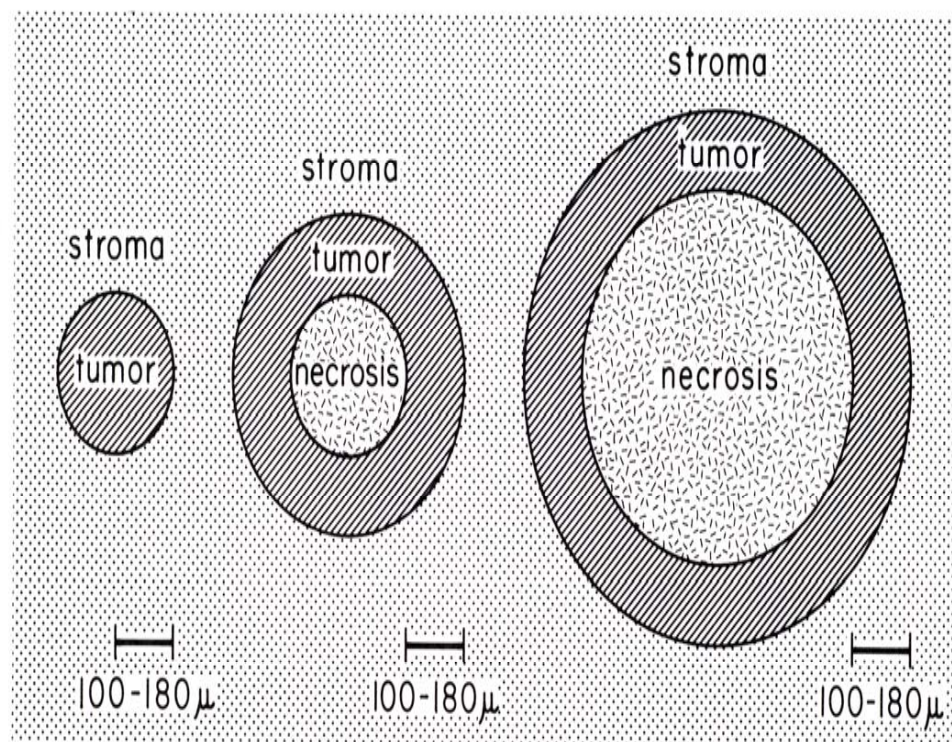
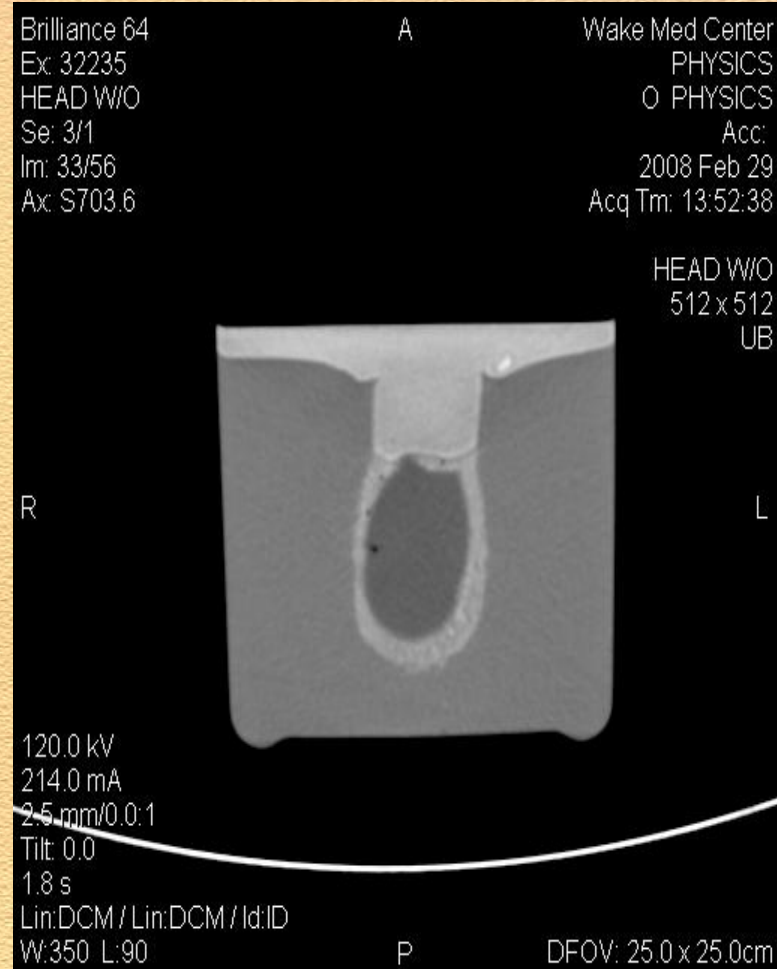


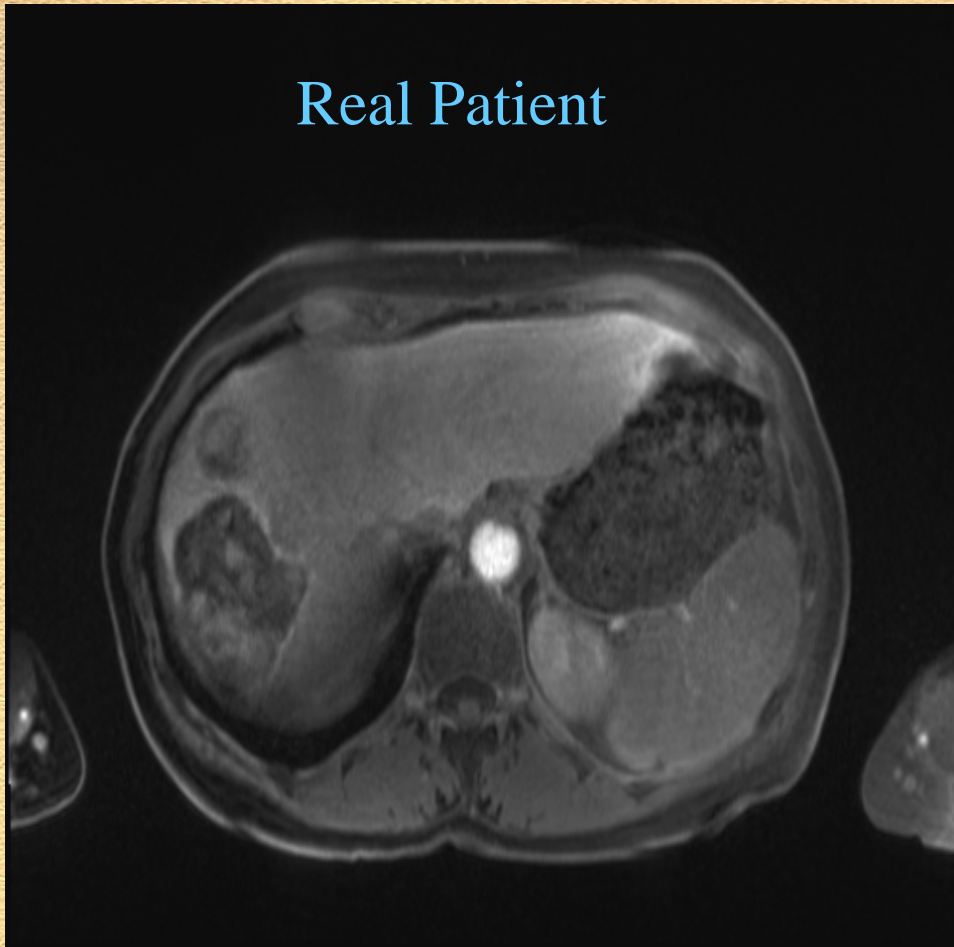
Figure 8-7. The conclusions reached by Thomlinson and Gray from a study of histologic sections of human bronchial carcinoma. No necrosis was seen in small tumor cords with a radius of less than about 160 μ m. No tumor cord with a radius exceeding 200 μ m was without a necrotic center. As the diameter of the necrotic area increased, the thickness of the sheath of viable tumor cells remained essentially constant at 100 to 180 μ m.



Courtesy Hall, E. Radiobiology 1998

Imaging-MRI

Real Patient



Phantom



Imaging-CT



Brilliance 64
Ex: 32235
HEAD W/O
Se: 3/1
Im: 36/56
Ax: S711.1

A

Wake Med Center
PHYSICS
O PHYSICS
Acc:
2008 Feb 29
Acq Tm: 13:52:38

HEAD W/O
512 x 512
UB

R

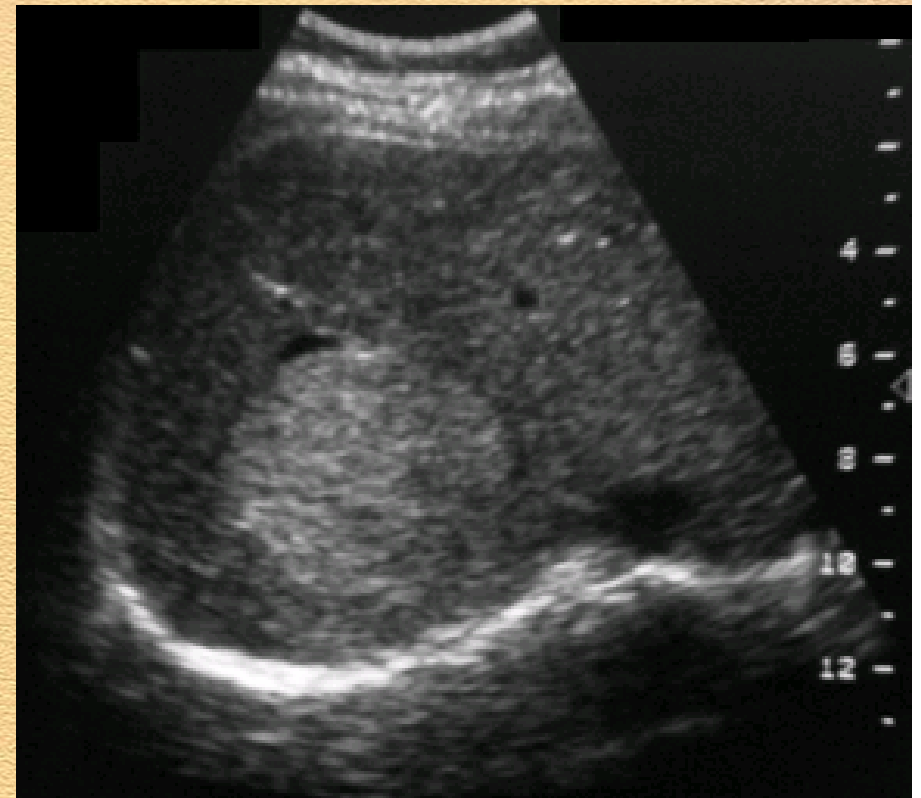
L

120.0 kV
214.0 mA
2.5 mm/0.0:1
Tilt: 0.0
1.8 s
Lin:DCM / Lin:DCM / Id:ID
W:350 L:90

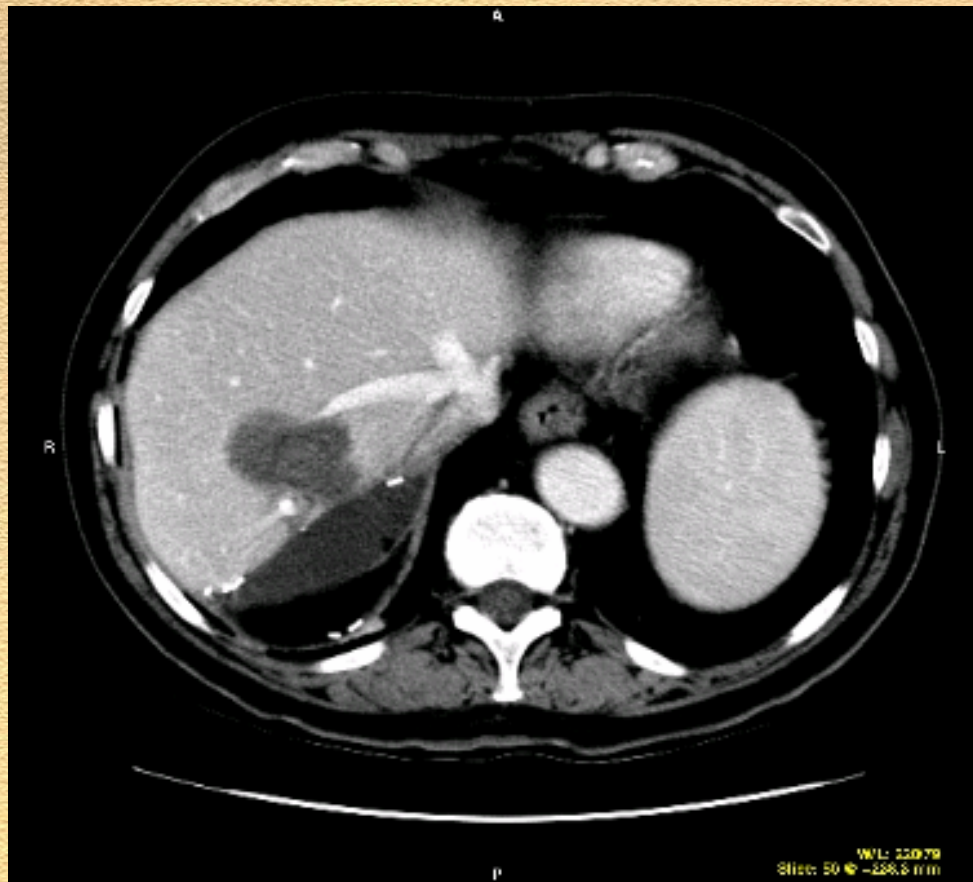
P

DFOV: 25.0 x 25.0cm

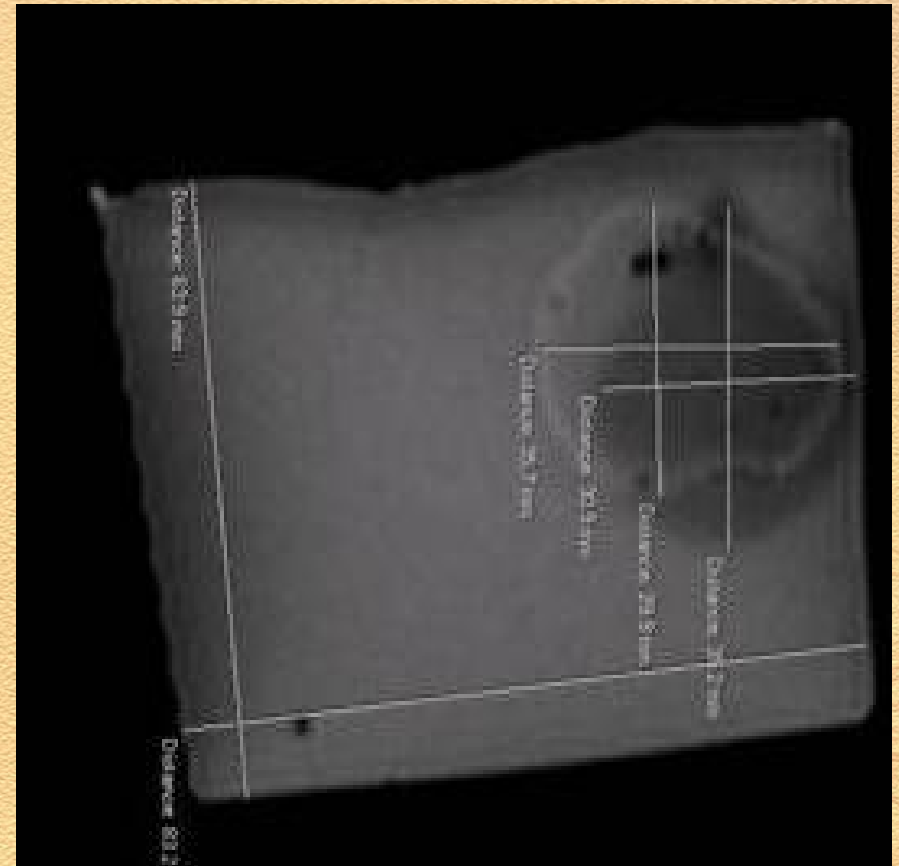
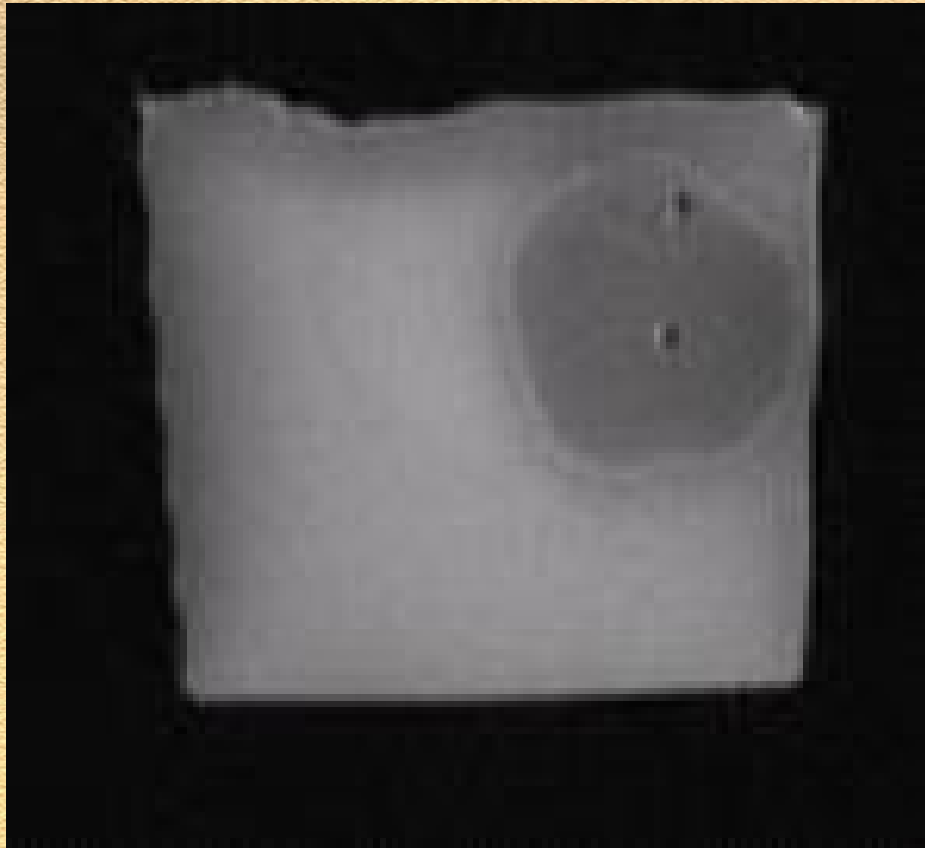
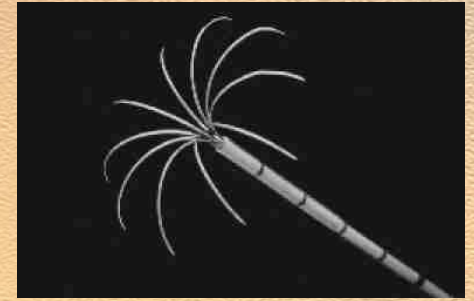
Imaging-US



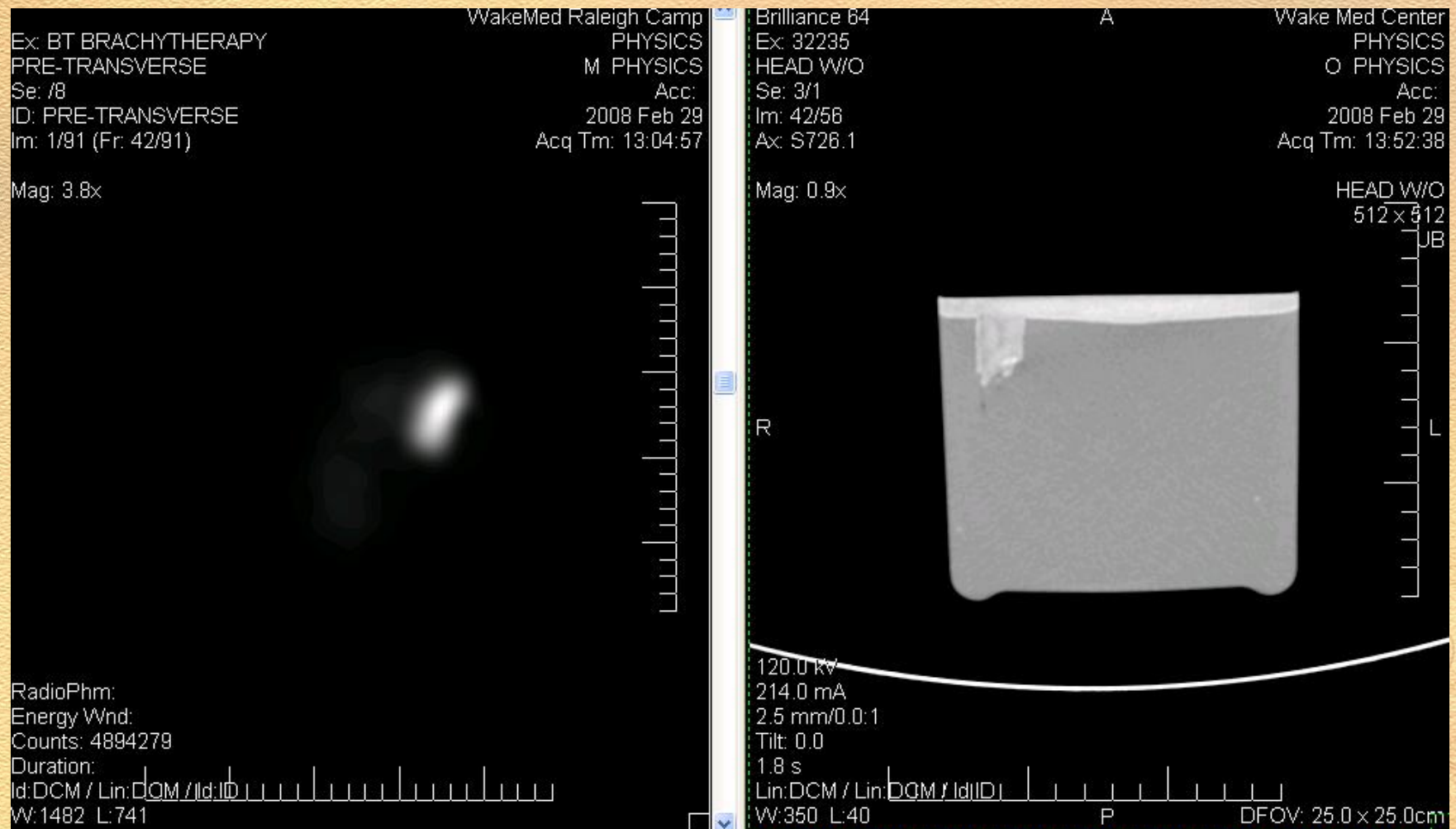
RFA-Thermal



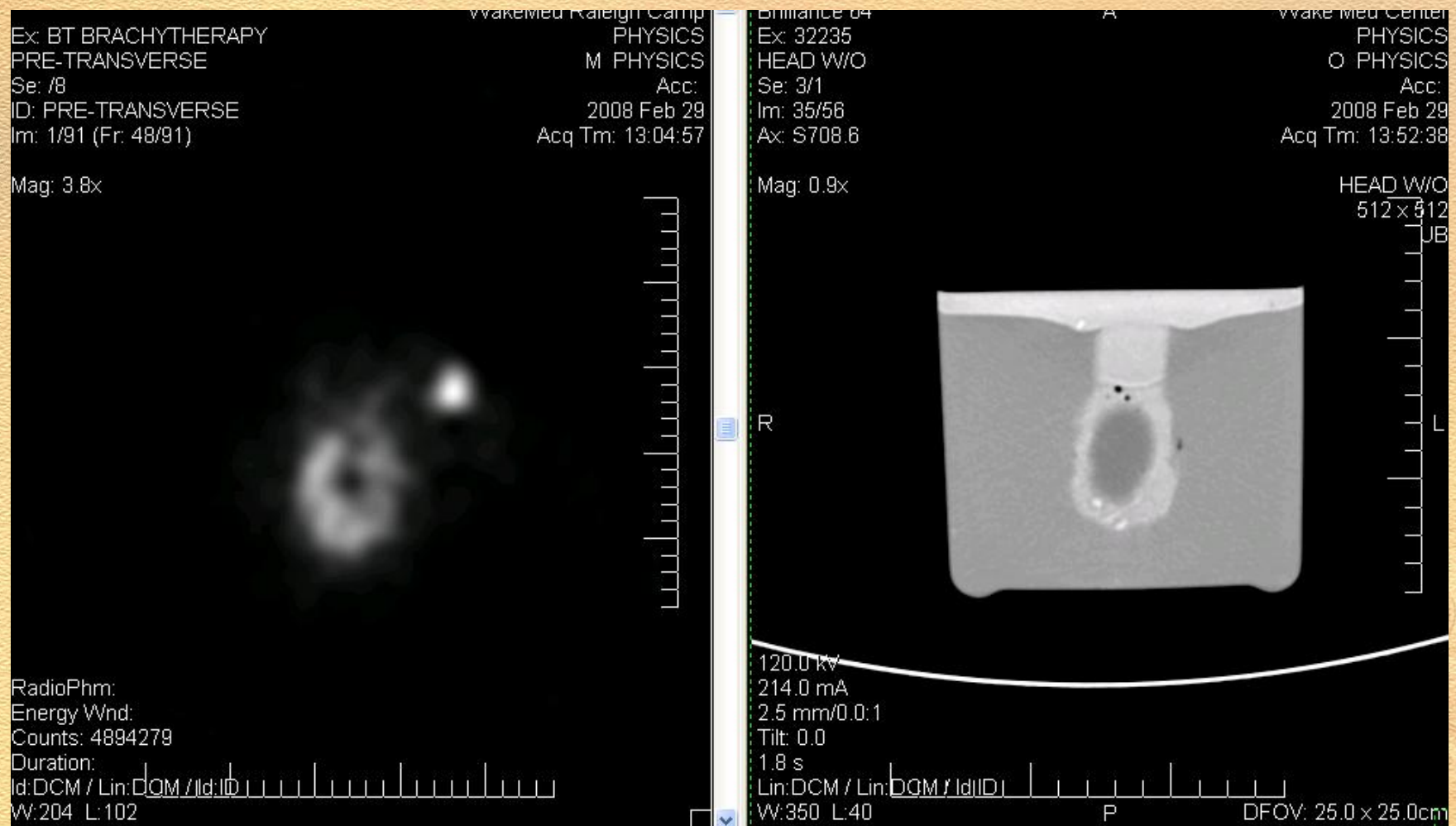
RFA- Before and After



Radiation



Radiation- Gamma (T99)

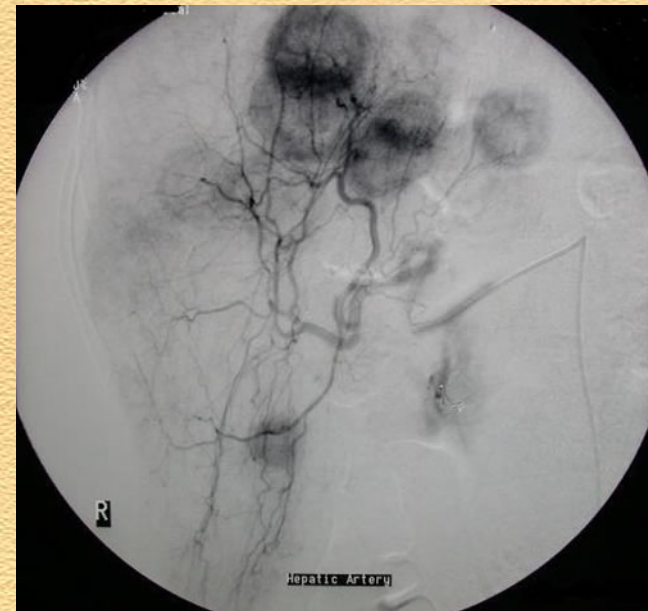


Radiation- Beta (Y-90)



Shortcomings

- Does not contain live cells, cannot test chemotherapy
- Does not have vascular system, cannot test endovascular therapies



Summary

- Production of tissue-mimicking liver phantom
- Imaging: MRI, CT, and US
- Radiofrequency Ablation
- Radiation



Shameless Plug

• GO **UNC**



Beat

Duke



The University of North Carolina at Chapel Hill



Oldest State University in the US: established 1773